DALTONIANA

NEWSLETTER
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THE LAST PAGE OF THIS ISSUE IS THE CALL FOR PAPERS AND PRELIMINARY INSCRIPTION FORM FOR THE SIXTH INTERNATIONAL IRGCVD SYMPOSIUM IN WEST-BERLIN (17th-19th SEPTEMBER 1981)

The new directorial committee of the IRGCVD coopted Ph. LANTHONY. It elected Prof. W.D. WRIGHT as president and confirmed Dr. G. VERRIEST, Prof. R. LAKOWSKI and Dr. M. MARRE in their previous functions. Invited speakers were chosen for the different themes of the Berlin symposium and are now contacted. -- Guy Verriest.

LITERATURE SURVEY

Enhancement of luminance flicker by color-opponent mechanisms, by P. GOURAS and E. ZRENNER (Columbia University, College of Physicians and Surgeons, 630 W 168th Str. New York 10032, USA), Science 205, 587-589, 1979.

Extracellular impulses of single ganglion cells in the retina of anesthetized *Macaca mulatta* were recorded with glass micropipette electrodes filled with 3M KCl solutions introduced into the eye through a closed chamber and guided to the retina by a hydraulic micromanipulator. A modified Bausch & Lomb fundus camera provided a means of presenting visual stimuli in Maxwellian view, seen in sharp focus on the retina. The light source was a 1000 W xenon arc lamp providing two independent beams : one for the flickering stimulus produced by a half-sectored disk (the wavelengths and energy of this beam were changed by narrow-band interference and neutral density filters); the second beam provided selective chromatic adaptation. Color-opponent ganglion cells in the retina of the rhesus monkey respond better to chromatic changes at low temporal frequencies and better to luminance changes at high temporal frequencies. This is due to a frequency-dependent phase shift between the color-opponent responses produced by the center and surround mechanisms in the receptive field of each of these cells. Spectrally antagonistic responses at low temporal frequencies become progressively synergistic at high frequencies. The cells become most responsive at high frequencies to those wavelengths to which they are least responsive at low frequencies. This phenomenon can explain the difference between chromatic and luminance flicker in human vision. - Ingeborg Schmidt.

Chromaticity diagram showing cone excitation by stimuli of equal luminance, by D.I. Mac LEOD and R.M. BOYNTON (Department of Psychology, University of California at San Diego, La Jolla, California 92093, USA), J. opt. Soc. Amer. 69/8, 1183-1186, 1979.

Color and luminance can be specified graphically by a point in the threedimensional space with orthogonal axes showing the excitation of each cone type (T.N. Cornsweet, Visual Perception, Academic N.Y., 1970, p. 189). Almost any plane in cone excitation space could serve as a chromaticity diagram in which each color is represented by the point where its line meets the plane. If the plane R+G+B = 1 is taken as the chromaticity diagram, colors fall within the obliquely oriented equilateral triangle. The advantages and drawbacks of this triangle are mentioned. In a space where Cartesian coordinates represent the excitations of the three cone types involved in color vision, a plane of constant luminance provides a chromaticity diagram in which excitation of each cone type (at constant luminance) is represented by a horizontal or vertical linear scale and in which the center-of-gravity rule applies with weights proportional to luminance. The spectrum locus and confusion lines of protanopes and deuteranopes are shown in the proposed chromaticity diagram. The advantages of the diagram over others including the CIE diagram are pointed out. It portrays physiological relationships that are disguised in previous chromaticity diagrams. A new advantage is that the weights for the different components in color mixture are proportional to luminance. - Ingeborg Schmidt.

Color discrimination from isomeric matching and different types of primaries fusion, by E. HITA, E. JIMENEZ and M. ALVAREZ-CLARO (University of Salamanca, Departamento de Optica, Salamanca, Spain), Atti Fond. G. Ronchi, 34/6, 718-727, 1979.

Color discrimination has been studied from isomeric matching for different types of primaries color fusion. The results obtained have been compared with those of a previous paper (dated 1976) on color discrimination from metameric matching. - Lucia Rositani-Ronchi.

Chromatic information processing, by M.J. NISSEN, J. POKORNY and V.C. SMITH (Department of Psychology, Florida State University, Tallahassee Florida 32306, USA), J. exper. Psychology, Human Perception and Performance 5/3, 406-419, 1979.

In experiment 1 involving discriminative reaction time (RT) chromatic and white stimuli appearing in a central circular field of 1.9° and of same luminance were presented on an achromatic background of 3.8°. Following stimulus onset, the field was equiluminant. The subjects with normal visual acuity, when corrected, and normal color vision were instructed to report only to the chromatic stimuli and withold responses to the white stimulus. RT was lowest at 570 nm, the least saturated stimulus, and somewhat faster to short than to long wavelengths. In experiment 2 the stimulus display and apparatus were the same. In one condition subjects were instructed to respond only to the chromatic stimulus, in the other only to white. RT was faster when subjects responded to color than when to white. The purpose of experiment 3 was to verify the perceptual changes produced by surrounds of different luminances (equal to or one log unit greater or one log unit less than that of the white and chromatic stimuli). In experiment 4 simple reaction time was measured to chromatic stimuli represented in hue substitution with the same three white surrounds but so that there was no luminance exchange accompanying stimulus onset. Experiments 3 and 4 demonstrated that a brighter white surround decreases the perceived brightness of chromatic stimuli as well as their perceptual similarity to white but did not affect RT. The results are discussed in terms of the response strength of the chromatic processing channels. - Ingeborg Schmidt.

Changes in color appearance with variations in chromatic adaptation, by C.J. BARTLESON (The City University, London EC IVN 4PB, England), Color, Research and Application 4/3, 119-138, 1979.

In the center of an achromatic high reflectant surround subtending 15.2° visual angle on each side a 1° aperture provided the test stimulus. The color sample appeared for 2 sec followed by a 10 sec period in which a shutter was closed to provide a uniform field. A series of 24 focal color stimuli, produced by various combinations of Lovibond glasses, Chance glasses and Cinemoid plastic filters, was used at each of three color temperature conditions (CIE illuminant A, D_{50} and D_{65}), three sample luminance factors (corresponding to Munsell values 3, 5 and 7) and three illuminances to study the effect of an inducing surround, namely 1000, 500 and 200 $cd.m^{-2}$. The observers were 7 normal trichromats, 20 to 53 years of age. Each observer was adapted to the uniform white surround for 20 min before each experimental session. The subject was first trained to recognize the color attributes lightness, colorfulness and hue. Colorfulness corresponds to "saturation". On magnitude-estimation experiments the observer was asked to assign a numerical value to hue and colorfulness of a stimulus. Perceived hue varies with color temperature of illumination but not significantly with luminance factor or illuminance in these experiments. Colorfulness varies with color temperature and also with luminance factor but is essentially independent of color temperature and illuminance over the investigated ranges. - The primary purpose of the research was to provide basic data that may be used to derive a method for predicting color appearances of surface color stimuli over a limited range of adaptation conditions of general interest in commerce and industry. - Ingeborg Schmidt.

Predicting corresponding colors with changes in adaptation, by C.J. BARTLESON (Research Laboratories, Eastman Kodak Co. Rochester, New York 14650, USA) Color, Research and Application 4/3, 143-155, 1979.

A method is proposed for determining chromaticity coordinates of color samples that elicit the same color appearances when an observer is adapted to different conditions of illumination. Such color samples are referred to as "corresponding colors." - Ingeborg Schmidt.

Using color substitution pupil response to expose chromatic mechanisms, by V.D. SAINI and G.H. COHEN (Department of Electical Engineering and Center for Visual Science, Hopeman Building, University of Rochester, Rochester, N.Y. 14627, USA), J. opt. Soc. Amer. 69/7, 1029-1035, 1979.

When two scotopically balanced fields at different wavelengths are alternated, the pupil shows constriction response at each threshold (M. Kohn and M. Clynes, Ann. New York Acad. of Sci. 156, 931, 1969) demonstrating that both, rods and cones, are responsible for pupillary constriction in response to light. Using a suitable model for pupillary innervation this response was systematically studied. An automated pupillometry laboratory has been set up to obtain human pupil responses. A 4° stimulus field was centered in the fovea. Different wavelengths and radiant power levels were applied to yield threshold curves for the chromatic mechanism "as indicated by the pupil". Four mechanisms have been identified having peak sensitivities near 450,525, 580 and 495 nm. The authors propose that these represent the blue, green, red and scotopic mechanisms as manifested before the level of the lateral geniculate body. Aside of experiments on color normals tests were carried out on a deuteranomalous who showed a reduced sensitivity of the green mechanism of the pupillary response, and on a protanope who's peaks were around 500 and 540 nm and 600 nm, the latter barely visible. - Ingeborg Schmidt.

A mechanical model for demonstration of color sensation in the human visual organ (Mechanisches Modell zur Demonstration der Farbempfindung im menschlichen Sehorgan), by H. KÜPPERS (Im Buchenhain 1, 6070 Langen-Oberlinden, West Germany), Der Augenspiegel 24/5, 216-239, 1978.

A detailed description of a mechanical model demonstrating the origin of color sensations. The model is suited to show the stages of events caused by a color stimulus : the excitation potential in the three cone types, the "black box", a kind of tunnel in our faculty of perception, and finally the color sensation. The model is also helpful in understanding of the color mixture laws. It shows that the method of functioning of the visual organ becomes the "fundamental law" of the science of color. - Ingeborg Schmidt.

Color is exclusively color sensation ("Farbe" ist ausschliesslich Farbempfindung), by H. KÜPPERS (Langen-Oberlinden, W. Germany), Der Augenoptiker 34/5, 89-93, 1979.

A review on common knowledge about color vision. Three stages can be distinguished as a response to a color stimulus, namely the excitation potential in the three cone types, the "black box", finally the color sensation. - Ingeborg Schmidt.

The effect of retinal image motion on vision in coloured light, by R.W. DITCHBURN & J.A. FOLEY-FISCHER (Department of Engineering, University of Reading, Whiteknights, Reading, England), Vision Research 19, 1223-1227, 1979.

Oscillatory movements were imposed on the stabilized image of a black bar on a light ground. The resulting increase (V_c) in the fraction of time for which the target could be seen was measured for different luminances and hues of the background light. Values of V_c depend mainly on luminance and little on hue. A critical cutoff frequency (f_c), above which movements did not increase V_c was measured. The relation between f_c and log L was found to be linear and independent of colour (hue) like that between CFF and log L (Ferry-Porter Law). - The Authors.

Studies on spectral sensitivity curves of the cone pigments, by T. YASUMA, H. ICHIKAWA (Department of Ophthalmology, Nagoya University School of Medicine), and S. TANABE (Nagoya First Red Cross Hospital Nagoya-shi), Acta Soc. ophthal. jap. 82, 627-634, 1978.

Spectral sensitivities of three cone pigments were isolated by the use of Wratten 21, 35 and 47B filters. Peak sensitivity of the blue cone pigment was located at about 440 nm, that of the green cone pigment at about 560 nm and that of the red cone pigment at about 580 nm.

The blue and the red cone pigments were certified under various bleaching backgrounds by the use of Wratten filters or monochromatic filters. But the green cone pigment was not isolated clearly, because it could not be kept away from the red cone pigment completely.

The following conclusion was obtained : the green cone pigment is easily bleached under various background conditions, but the red cone pigment is not completely bleached even under any particular background condition.

This conclusion supports the assumption that a spectral sensitivity curve chiefly depends upon the red cone pigment. - Yasuo Ohta.

Isolation of anomalous cone pigments : flicker detection method and its application, by T. YASUMA and H. ICHIKAWA (Department of Ophthal., Nagoya University School of Medicine, 65 Tsuruma-che, Showa-ku, Nagoya 466, Japan), Japanese Journ. of Ophthal.. 23/1, 17-30, 1979.

The cone pigments were isolated on two protanomals, two deuteranomals and two normal controls by a "flicker detecting method", which was combined of the "exchange threshold method" by Rushton, modified by Piantanida et al. (Vision Res. 16, 1092, 1976) and the "chromatic adaptation method" by Wald (Proc. nat. Acad. of Sc. 55/6, 1347-1363, 1966). The flicker fusion thresholds of two monochromatic beams, 540 nm and 600 nm, were measured against a steady monochromatic background of 5°. The two beams were polarized at right angles to each other. They passed through a beam splitter and then through a motor driven polarizing filter to produce sinusoidal flicker. The field was limited by a 2° circular stop. The flickering beams and the steady 5° monochromatic background beam merged in another beam splitter. Observation was in Maxwellian view through a 2mm pupil. The frequency was kept in the range of 10-20 Hz. The flicker fusion thresholds were determined by changing the intensities of each monochromatic background. The retinal illuminance was kept low since on higher illuminances the spectral luminosity curves were obtained instead of the sensitivity curves of the anomalous pigments. In the wavelength range longer than 500 nm only two cone pigments are active. One of the two types of pigments was silenced by adjusting the relative amplitudes of the 540 nm and 600 nm sine wave stimuli. Then the flicker threshold will be detected only by the luminous sensitivity of the other pigment (see Kelly and V. Norren, Daltoniana No. 30, p. 1). The peaks of the sensitivity curves of the protanomalous and deuteranomalous cone pigments were located at almost the same wavelength. Thus the pigments may be identical.- Ingeborg Schmidt.

Large-field color naming of dichromats with rods bleached, by A.L. NAGY and R.M. BOYNTON (University of California at San Diego, Department of Psychology, La Jolla, California 92093, USA), J. opt. Soc. Amer. 69/9, 1259-1265, 1979.

The large-field red/green discrimination of four protanopes and four deuteranopes was examined using a color-naming method (12° annular field, with the central 4° removed, flashes of 300 ms). Four wavelengths (530, 570, 610 and 650 nm) were equated in brightness for each observer at two retinal illuminance levels, approximately 10 and 100 td. The observer fixated an imaginary point midway between two fixation points separated by 15°, corresponding to the center of the flashed test stimuli. The stimuli were presented in random order and the observer was asked to name each, using one of four color terms : red, green, orange or yellow. The experiment was carried out with the observer dark adapted for 20 min and also with the rods bleached (400.000 td white field viewed for 4 min then in the dark for 5 min). Then 16 stimuli were presented one every 15 sec. For all four deuteranopes and two of the protanopes color names were significantly related to both illuminance and wavelength. The relationship between name and wavelength was similar to that of a normal trichromat, however the performance of dichromats was very poor. It was somewhat better in dark than with the rods bleached. However there is evidence that at least some observers classified as dichromats with small-field procedures actually have a weak residual third cone mechanism. - Ingeborg Schmidt.

Eight cases of congenital achromatopsia with amblyopia in two pedigrees from northern Sweden, by W. POLLAND and S. NORDSTRÖM (Depts of Ophthalmology and Medical Genetics, University of Umeå, Umeå, Sweden) Acta ophthal. (Kbh) 57, 653-664, 1979.

Eight patients in two families showed typical signs of congenital achromatopsia; their colour sense was clearly abnormal when tested with pseudo-isochromatic plates, the 100-hue test and Nagel's anomaloscope. Six of 13 near relatives tested showed minor colour vision defects. The mode of transmission was consistent with an autosomal recessive inheritance in both families. The abnormalities of the relatives suggest a tendency towards heterozygotic manifestation. - Anders Hedin.

Rod sensitivity relative to cone sensitivity in retinitis pigmentosa, by R.W. MASSOF and D. FINKELSTEIN (Wilmer Ophthalm. Inst. Johns Hopkins, School of Medicine, Baltimore, Md 21205, USA), Invest. Ophthalm. a. Vis. Science, 18/3, 263-272, 1979.

Measures of absolute thresholds of 75 patients with retinitis pigmentosa on a Tübinger perimeter, using a red stimulus (μmax 650 nm) and a blue-green stimulus (μmax 500 nm), resulted in the distinction of three groups of patients : for one group it appears that only cone function is present in all parts of the visual field, for another group, despite large losses in absolute sensitivity, rod sensitivity still exceeds cone sensitivity by at least the normal factor suggesting concomitant rod and cone sensitivity losses, for a third group it appears that central retinal thresholds are determined primarily by cones, midperipheral retinal thresholds by a composite of rod and cone function and far-peripheral thresholds predominantly by rods. A discussion of the results leads to the conclusion that the different groups of threshold results represent different disease mechanisms rather than different stages of progression in a single disease. - Ingeborg Schmidt.

Vision threshold profiles in X-linked retinitis pigmentosa, by R.W. MASSOF and D. FINKELSTEIN (Wilmer Ophthalm. Institute, Johns Hopkins Hospital, Baltimore, Md. 21205, USA), Invest. Ophthal. a. Vis. Science 18/4, 426-429, 1979.

Evidence from psychophysical studies suggest that X-linked RP may represent a homogenous group. Absolute thresholds for bluegreen and red stimuli were measured along the horizontal and vertical meridians. The methods are described in an earlier paper (R.W. Massof and D. Finkelstein, Invest. Ophthal. 18/3, 263, 1979). The data indicate that 1) there are probably no functioning rods within the central 10° 2) because the foveal cones are abnormal they are reduced in sensitivity by 1 log unit and both patients have a strong blue-yellow color vision defect 3) because of the ring scotoma there probably are no functioning midperipheral rods or cones 4) there is evidence that in the far periphery there must be functioning, albeit abnormal, rods and cones. - Ingeborg Schmidt.

Focal cone electroretinograms in dominant retinitis pigmentosa with reduced penetrance, by M.A. SANDBERG, M.H. EFFRON and E.L. BERSON (Berman-Gund Laboratory, 243 Charles Str. Boston, Mass. 02114, USA), Invest. Ophthal. 17/11, 1096-1101, 1978.

From three young patients with dominant retinitis pigmentosa, with reduced penetrance, focal electroretinograms from the green and red cone systems in combination were elicited with a method of rod silent substitution. With this method, two alternating lights of different wavelength, matched in brightness for the rods, were presented to the same retinal area. The brighter light for the green and red cones was designated as the stimulus increment and the dimmer light as the background. The findings support the idea that the abnormal midperipheral cone ERG's observed in the early stages of the disease are due in part to a decreased state of adaptation of the cone system. - Ingeborg Schmidt.

Congenital cone dysfunction, by J.D. BARTLETT (School of Optometry, The Medical Center, University of Alabama, Birmingham, Alabama, USA), Amer. J. Optom. Physiol. Opt. 56/3, 206-210, 1979.

Description of three unrelated cases : 1) an 11 year old boy with extreme photophobia, V.A. 6/24 OU, normal slit lamp findings, visual fields and fundi. On the ERG the response to red light and flicker was absent. The D-15 test disclosed a protan defect on the right eye and no color vision defect on the left eye, 2) a 14 year old boy with V.A. 6/21 OU, no extreme photophobia, on the ERG a 50% reduction of the cone response. The D-15 test did not show a significant color vision defect, but on the FM 100 hue test he had marked bipolar confusions in the deutan range, 3) a 27 year old female with V.A. 6/36 OU, extreme photophobia, fixation difficulty, but no nystagmus, atypical ERG responses. She had color deficiency since birth, called all caps brown or black on the D-15 test. All three cases were diagnosed as congenital cone dysfunction and a mode of inheritance assumed, despite of scarse data (X-linked recessive in case No. 1, autosomal recessive in the two other cases). - Ingeborg Schmidt.

Familial cerebro-macular degeneration (The Stengel-Batten-Mayou-Spielmeyer-Vogt-Stock disease), Evaluation of the photo-receptors, by E. HANSEN (Dept. of Ophthalmology, Rikshospitalet, University of Oslo, Oslo, Norway), Acta ophthal. (Kbh), 57/3, 382-396, 1979.

Among seven patients described it was possible to perform more extensive studies in a few. These studies included colour vision tests, adaptometry, ERG, and static perimetry and spectral sensitivity measurements with neutral and coloured backgrounds. Deterioration of vision was typically the first symptom the patients complained of. In the early phase, there was red-green deficiency and moderate increment of night vision thresholds. Later, achromatopsia developed followed by large central scotomas and finally blindness. Blue cones are spared longer than red and green ones, and the early colour vision deficiency is thus of the Verriest type I. - Anders Hedin.

Scotopic axis in some 100-hue responses of patients suffering from multiple sclerosis, in relation to visual acuity, by A. SERRA (Cattedra di Ottica Fisiopatologica dell'Università di Cagliari, Cagliari 09100, Italy), Atti Fond. G. Ronchi 34/4-5, 472-476, 1979.

Nineteen out of 81 patients suffering from multiple sclerosis show a scotopic axis in their 100-hue responses. However, only 3 of them conform to the visual-acuity/total score relationship expected for young normal people under reduced illuminance. It is as if there were two kinds of scotopisation : one affecting both the chromaticity and the brightness channels, the other affecting the brightness channel only. - Lucia Rositani-Ronchi.

Visual acuity deterioration in acquired color vision deficiencies, by L. BARCA and G. VACCARI (Clinica Oculistica dell' Università di Firenze, Careggi-Firenze 50100, Italy), Atti Fond. G. Ronchi 34/4-5, 495-501, 1979.

On the basis of some data produced by Verriest in 1964, we calculate the equation of the straight line fitting at best the relationship of the total score at the 100-Hue test (corrected for senescence) and visual acuity. The slope of the linear best fit is found to be very small in some diseases, denoting the independence of visual acuity deterioration and color discrimination deterioration. In other diseases, the slope is very high, denoting a strict correlation between the deteriorations of both the said visual functions. - Lucia Rositani-Ronchi.

Edrige-Green Lecture, by W.O.G. TAYLOR (16 Ronaldshaw Park, Ayr, Scotland), Trans. ophthal. Soc. U.K., 98, 423-445, 1978.

Most of this paper deals with vision disabilities of albinos in general, colour is discussed here. Discussing the red deviation noted by himself and R.W. Pickford on both Nagel and Pickford anomaloscopes in albino subjects, Taylor finds that Waardenburg (1970) as well as Skro and Berg (1974) appear to agree with them, while the results of Bergsma and Kaiser-Kupfer (1974) which they thought contrary, in fact have been misinterpreted, and in fact support Pickford. Dodt and his colleagues' results on the other hand cannot be compared since they did not use an anomaloscope and in any case their patients do not seem to be the same. - The Author.

Histologic analysis of photochemical lesions produced in rhesus retina by short-wavelength light, by W.T. HAM jr., J.J. RUFFOLO jr., H.A. MUELLER, A.M. CLARKE and M.E. MOON (Dept. of Biophysics, Box 877, Virginia Commonwealth University, Richmond, Va. 23298, USA), Invest. Ophthal. 17/10, 1029-1035, 1978.

Retinal lesions produced by extended exposure (1000 sec) to low corneal power levels (62 µW) of 441 nm (interference filter, 6nm band width) in 20 rhesus eyes were observed by light microscopy, 1 hr to 90 days after exposure. The lesions, 1 mm in diameter, were produced in the paramacular and macular area. Nearly double the paramacular exposure was required to produce a macular response, obviously due to the protective effect of the yellow macular pigment. On three animals, which had been trained to perform visual acuity tasks, a return to normal vision was found to depend on the radiant intensity applied. The results indicate a nonthermal type of photochemical lesions in the retinal pigment epithelium. A hypopigmentation appeared after 48 hours. This type of lesion helps to explain solar retinitis and eclipse blindness and has significance for aging and degenerative changes in the retina. - Ingeborg Schmidt.

Some remarks on working spectacles and related topics, by S. VILLANI, B. CIPOLLA and G. CASINI (Istituto Superiore di Optometria, Vinci, Florence, Italy), Atti Fond. G. Ronchi, 34/6, 648-668, 1979.

A bibliographical review on an ergo-ophthalmological problem, concerning the most appropriate correction of refraction, determined "in situ", at the working place. Amongst others, reference is made to color vision, through topics like "accommodation and spectral composition of illumination", "wavelength focused on the retina, across the image of a white source", "red goggles, red lights", "yellow tinted spectacles". - Lucia Rositani-Ronchi.

Color deficiency : is it still a handicap? by H.I. ZELTZER (57 Grant Str., Waltham MA, 02154, USA), J. Amer. optom. Assoc. 50/6, 761, 1979.

After shortly reviewing the rôle color plays in day-to-day living the author states that "color deficiency was untreatable until the advent of the X-Chrom lens... Many X-Chrom patients can function satisfactorily on the job yet may have difficulty passing a test which measures degree and type of deficiency only... Job-related color vision testing is now necessary to diminish this discrepancy." - Ingeborg Schmidt.

Chromostereopsis (Die Farbenstereoskopie), by J. REINER (Stefan Lochner Str. 14, 5000 Cologne 50, W-Germany), Der Augenspiegel 24/5, 200-215, 1978.
Review about chromostereopsis with detailed explanation of its nature. - Ingeborg Schmidt.

Goethe's examination of colour blind people (Goethes Untersuchungen an Farbenblinden), by W. JAEGER (Universitäts-Augenklinik, Bergheimerstrasse 20, 6900 Heidelberg, B.R.D.), Heidelberger Jahbücher 23, 27-38, 1979.
A very interesting and clear summary of the backgrounds, methods of examination and conclusions of Goethe's work on colour vision defectiveness, with a beautiful colour plate. - Guy Verriest.

Fundamentals of color vision. Part I. by L. GENCO (500 Fillmore, Wichita Falls, Texas, 76301, USA), Optom. Monthly 69, 959-963 and 1050-1054, 1978.
The basic terminology and principles of color perception, theories of color vision, color vision deficiencies and tests for screening are reviewed for optometric assistants. Simulation of color vision deficiency is demonstrated. - Ingeborg Schmidt.

Clinical implications of color vision research, by P.L. PEASE (The New England College of Optometry, 424 Beacon Str. Boston, Ma. 02115, USA), J. amer. optom. Assoc. 50/6, 739-743, 1979.
The attributes of color and the basic mechanisms underlying normal and defective color vision are reviewed. Our knowledge on action spectra is crucial to our understanding of both normal and defective color vision. The clinical implications of some research efforts bearing on congenital and acquired color vision defects, on peripheral color vision and the influence of photostable pigments on the color vision status is presented. For both congenital and acquired color vision defects the clinical tests are ordinarily the same. - Ingeborg Schmidt.

Color Vision. An historical introduction, by Gerald S. WASSERMAN. John Wiley a. Sons New York, 1978, 2444 Pg.
[In this book Chpt. 4 Color blindness Chp. 4 Component theories, Chpt. 6 Opponent theories Chpt, 7 Zone theories.]

Visual Psychophysics and Physiology.
A volume dedicated to Lorrin Riggs, Edited by J.C. Armington, J. Krauskopf, B.R. Wooten. Academic Press, New York. San Francisco, London 1978, 488 pg.
[This book contains a chapter on color vision by R. Boynton, C.R. Čavonius, O. Estevez, T.N. Cornsweet.]

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COLOUR GROUP (GREAT BRITAIN)
Notice of 149th Meeting
One-Day Meeting on Post-Receptoral Processes in Colour Vision-
Wednesday, 9th January, 1980.
Abstracts

<u>Inhibitory interactions between red- and green-sensitive cone mechanisms</u>, David H. Foster.

The field spectral sensitivities of the red- and green-sensitive colour mechanisms determined by Stiles' method are found to be modified when measured in the presence of a small auxiliary conditioning field. For the green mechanisms, a 620 nm auxiliary field coincident with the test flash (diameter 0.15°, duration 200 ms) shifts peak spectral sensitivity towards short wavelengths. For the red mechanisms, a 500-nm auxiliary field coincident with the test flash shifts peak sensitivity towards long wavelengths.

This spectral-sensitivity shift is diminished for short test flashes (e.g. 20 ms) and is absent for auxiliary fields much smaller or larger than the test flash. The effect does not occur dichoptically.

It is suggested that the small superimposed auxiliary field facilitates detection by chromatic channels arising from an inhibitory interaction between the outputs of the red- and green-sensitive cones.

<u>Dynamics of a colour-opponent site</u>, J.D. Mollon, P.G. Polden & A. Stockman.

During the first minute of exposure to strong adapting fields there may occur curious and rapid variations in the sensitivity of the eye to short-wavelength targets. If the field consists of only a long-wavelength component (e.g. 575 nm, $10^{11.7}$ quanta.sec^{-1}.deg^{-2}), the threshold for detecting a 436-nm test flash first rises and then falls; if the long-wavelength field is combined with a short-wavelength field (e.g. 440 nm, $10^{10.6}$ quanta.sec^{-1}. deg^{-2}), the threshold first falls and then rises, asymptoting at the saturated value previously reported for the steady state after 4 minutes (Mollon & Polden, 1977, <u>Nat.</u>, <u>265</u>, 243).

Under the conditions we have examined, the long threshold may change at a rate exceeding 1 db.sec^{-1} and a conventional 'staircase' procedure cannot faithfully track such rapid changes in sensitivity. We have therefore been led to develop a special psychophysical method, which we call <u>transverse titration</u> or the <u>Thousand Staircases</u>. The observer makes successive runs through the adapting sequence, with rests between runs. On a given run, target flashes are presented at a series of delays (Δt) after the onset of the adapting field; the stimulus delivered and the response given at each value of Δt is stored by a laboratory computer and is used to adjust the intensity of the flash at that Δt on the next run. Thus an independent staircase is maintained for each value of Δt.

We relate the results obtained to a model in which signals from the short-wavelength receptors are transmitted only via colour-opponent channels. It is supposed that opponent channels are most sensitive when close to the centre of their response range, that is, when long- and short-wavelength inputs are balanced (Pugh & Mollon, Vision Res., 19, 293); and that the strange variations in psychophysical sensitivity arise as the long-wavelength input to the opponent channel falls during early light adaptation to the bleaching field.

Postreceptoral adaptation in normal and clinical vision, P.E. King-Smith. Two independent studies are described. In one investigation, foveal spectral sensitivity curves were measured in normal subjects on various intensities of a "neutral" background which was calculated to stimulate the red and green-sensitive cones equally. At all intensities, spectral sensitivities in the range 480-680 nm could be fitted by assuming independent detection from an "L mechanism" peaking at 555 nm and a "C mechanism" peaking at 605 nm. The L mechanism is more adapted by the neutral background than the C mechanism, the increase in log threshold being 1.17 times greater. The simplest interpretation of these results is that the additional adaptation in the L mechanism occurs at a post-receptoral stage.
In another study, it is shown that, in clinical subjects, visual sensitivity from blue cones is often much more depressed on a yellow background than on white. These results indicate a defect in the adaptation mechanism of the blue-yellow opponent system.

New psychophysical methods for the spectral analysis of post-receptoral mechanisms in human vision, K. Ruddock & V. Waterfield.
Psychophysical methods for the spectral analysis of visual function, including colour matching an two-colour increment threshold measurement, yield broad-band spectral responses closely related to the absorption spectra of the cone photopigments (e.g. Brindley, 1970). We describe experiments which involve binocular interaction in adaptation to spatial patterns (Ruddock and Wigley, 1976; Ruddock, 1978), and the results therefore reflect activity in post-receptoral visual mechanisms. Three independent spectral responses have been obtained; one is driven by opponent inputs from the red- and green-sensitive cone mechanisms, a second by the green-sensitive mechanism, with a small inhibitory contribution from the red-sensitive mechanism, and the third, spatially coarser than the other two, is driven by the blue-sensitive cone mechanism. It is shown that the spectral response function of the red-green opponent mechanism corresponds to a simple linear combination of the red (π_5) and green (π_4) -sensitive response functions of Pitt (1944) and Stiles (1978), and that this mechanism is absent in the response of a deuteranopic dichromat. The development and application of experimental methods similar to those described

is necessary for the analysis and classification of acquired colour vision defects involving abnormal post receptoral function. Such investigations are also of value in the analysis of normal and congenitally defective colour vision.

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RUDDOCK, K.H. Proc. 11th Congress Intl. Comm. for Optics, 33-46 (1978).

RUDDOCK, K.H. and E. WIGEY, Nature, 260, 604-606 (1976).

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Cortical representation of colour, S. Zeki.

New insights into the representation of colours in the cerebral cortex and the variables governing the responses of single cortical colour-coded cells have been gained bythe discovery of specific visual cortical areas with high concentrations of such cells. The properties of these colour-coded cells will be discussed in terms of Land's retinex theory.

Colour preferences, I.D. McManus, A.L. Jones & J. Cottrell.

Previous work on colour preferences in man has failed to assess several possibilities :

i) That hue, value and chroma may all have separate effects upon preference.

ii) That preferences may change within an experimental session.

iii) That there may be substantial differences between individuals in their preference patterns.

In this paper we will describe an experiment in which all of the above features have been included.

I will also describe briefly some work on the colour of tablets and pills in relation to their pharmacological effect. (From the Inter-Society Color Council News, Nr. 264, Jan. Febr. 1980).

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PROJECT 113 : LIGHT SOURCES - Optimum requirements for medical diagnosis.

William C. Beck, M.D., a surgeon with a longtime interest in lighting, is conducting this project which hopefully will lead to guidelines for selecting lighting for use in healthcare practice. The role of lighting in clinical medicine is important to the physician because diagnosis of an ailment frequently depends upon identifying an abnormal coloration of the patient.

Dr. Beck, who heads the Guthrie Foundation for Medical Research Sayre, Pa., where he is also conducting this study, is duplicating and extending medical lighting surveys performed earlier in England.

There several separate reports led to the adoption of fluorescent lighting and the recommendation of a color temperature of approximately 4000K for medical practice. Dr. Beck felt that the specifics of the British recommendations might have been different had the types of lamps included those now available in the United States. He therefore designed this project to use a testing device similar to that used in England, and to augment the British battery of lamps with a variety including deluxe fluorescent and special tubes he believes deliver better visual clarity with lower energy input.

The testing device is a rotating drum divided into four compartments, each being equipped with two fluorescent lamps. In the present studies, Dr. Beck is also using standard light boxes for side-by-side comparison. The drum is rotated over the object being viewed. Patients have not been used thus far. Flesh is being represented by chunks of meat. The lamps used here are standard cool white, standard warm white, color-improved cool white (deluxe), color-improved warm white (deluxe), and simulated daylight sources. Fluorescent lamp manufacturers, advised of the project, are being asked to provide lamps of different applicable spectral responses if they desire.

The tests are forced choice, and patterns of presentation are scrambled to avoid inaccuracies due to the learning process. Tests include lamps of both high and low color-rendering qualiteis.

Colors in diseases. - Such clinical conditions as the following, which involve color evaluations, are being observed :

Mild jaundice; small changes in the pigment of the skin as is present with hyperthyroidism; mild and overt cyanosis (blueness of the skin); the browns and tints of red, purple, and blue present in dermatological disorders; pinks, purples, whites, yellows, and greens frequently present in pathology studies; pale yellows, buffs, and oranges against the variety of backgrounds found in bacterial cultures; various saturations of carboxyhemoglobin; various colors found in dipstick chemistry tests such as blood in stool, bilirubin, ketones, glucose, protein, urine pH, etc., and the tones involved in the matching of tooth fillings to dentine. - From the Illuminating Engineering Research Institute (IERI) 1977 Annual Report, p. 37.

ANNOUNCEMENT

GOLDEN JUBILEE OF COLOUR IN THE CIE

London 28-29.9.1981

The Colour Group (Great Britain) announce that they are organising a two-day Symposium to be held in London, England on Monday and Tuesday, 28th-29th September 1981 to celebrate 50 years of colour activities in the CIE (1931-1981). Invited lectures will be given on topics covering the work leading up to the CIE 1931 standard observer and subsequent developments and on applications of the CIE recommendations in a number of areas. Information : Miss M.B. Halstead,
Thorn Lighting Limited,
Jules Thorn Lighting Laboratories,
Great Cambridge Road,
Enfield, Middx, UK.